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Planting The Seed: The Svalbard Global Seed Vault as an Archive in the Face of Uncertain Futures

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Abstract

Cultural preservation is an evolving phenomenon that has historically been undertaken through the written or oral passage of knowledge from one generation to the next. Some archives emerge so individuals can understand their social, cultural, and personal histories, while others emerge to preserve non-human-related specimens to prepare for worst-case scenarios. This paper discusses the notion of the "doomsday" archive and connects it to concepts of archival practice by exploring the history and efficacy of the Svalbard Global Seed Vault and the various ways humans have used archival principles to mitigate harm in the face of global catastrophes.

Keywords

doomsday archives, global seed vault, emerging archives, climate change and archives, agriculture and archives, conservation biology and archives

Introduction

Archives are places that, among other functions, store and preserve the stories of individuals and communities, events, and various forms of cultural knowledge. They are institutions tasked with collecting, maintaining, and preserving cultural and intellectual information in its various documentary and media formats so we can collectively understand our histories. There is an enduring throughline of the archive, which craves to have its "achievements endure across generations . . . both orally and in writing and through dance, rituals, art, music, and performance" (Cunningham, 2017, pp. 55–56). However, the functions and mandates of archival institutions vary depending on the context in which they exist and the objectives of those who control them (Cunningham, 2017, p. 56) that impact how knowledge is preserved and made accessible. The purposes of an archive vary—some archives emerge so individuals can understand humanity's past, while others exist to preserve non-human-related specimens. Some specialized archives exist at the intersection of these collection priorities, with extended preservation plans and infrastructure networks to prepare for worst-case scenarios. This need for disaster preparedness is how the Svalbard Global Seed Vault, a Norwegian government-backed project, approached global agricultural crises, seeking to preserve the world's seeds in the face of social, environmental, and political challenges around the world. It is unclear whether the worst could or would happen, but archivists, to a certain extent, have the potential to help support society in restarting life in the event of a global catastrophe by engaging with these kinds of long-term preservation efforts. The history of the Svalbard Global Seed Vault and the treaty that prompted its existence is exemplary of the evolving intersection of the archive and climate change action, where the "doomsday" archive's role goes beyond merely safeguarding humanity's histories from global and natural disasters, but also allows for plant eventual re-growth, in the event of such a disaster.

"Doomsday" and the Archive

Doomsday archives are not well documented within archival literature. While their name may seem intuitive—meaning something like "archives that maintain various kinds of information in case 'doomsday' occurs"—it is challenging to come to an exact definition given the lack of research in the area. Articles about future-proofing archives, creating more robust archival collections, and implementing protective strategies call for having backups of metadata, stable storage conditions, low oxygen areas to mitigate the risk of fire damage, and controlling moisture levels to prevent mould, among other conservation and preservation concerns (Michalski, 2000). But none of these resources describe how to protect materials against rising sea levels, meteor strikes, nuclear war, solar winds, asteroid impacts, super volcanoes, and other catastrophic or world-ending events, all of which could constitute "doomsday." This begs the question: Does the "doomsday" archive need to be closed away forever? If not, what makes this kind of archive different from a time capsule?

To provide an example, there are organizations like the Arctic World Archive (AWA), which have made it their mission to "protect the world's historically and scientifically important data in the event of a future cataclysmic disaster" (Lawlor, 2017, para. 2) to "help preserve world memory" and "irreplaceable information for the benefit of future generations" (Braidwood 2023, para. 9). AWA is a for-profit organization where individuals keen on backing up their data can pay to store megabytes of data for the super-long term (Arctic World Archive, n.d.). However, AWA only stores digital data—no physical cultural heritage items are stored on site. While it is not a requirement to be a non-profit to be considered an archive, the relationship between accessibility, research functionality, and archival mandates is part of what separates a traditional archive from an off-site storage facility in the Arctic.

Unlike a traditional archive, the AWA does not anticipate their objects to have research value. Part of the appeal of the AWA is that owners will remain anonymous, therein item- or fonds-level finding aids are not available. Finding aids are among some of the key features of archival practice for both traditional and community archives that are lacking in the case of the AWA. Thus, the term "archive" is misused here, as it seems to represent an idea that archives are simply secure storage locations, without "users," per se, only donors. All the same, this misinterpretation dominates the contemporary understanding of a "doomsday" archive, as the AWA is the only Google search yield and University of Toronto Library database search result for "doomsday archive," outside of the young adult book series of the same name.

The AWA should not be the model for a doomsday archive. Rather, the concept better applies to the Svalbard Global Seed Vault (SGVS), whose existence grew from a need to establish a setting designed to protect natural specimens in the event of potentially (or definitely) world-ending emergencies. Conceptualized as a premium version of age-old gene banks with the function of preserving agricultural crop seeds, the SGVS keeps stable storage conditions, prioritizes holding large varieties of crops, and maintains as much genetic diversity as possible in its collection (Greene et al., 2014). The SGVS's collection area is international, at a scale and with protective measures several times higher than other extant gene or seed banks.

Treaties and Traditions: The Background to the Svalbard Global Seed Vault

Humans have long been collecting and storing seeds for preservation and agricultural research. Freezing seeds for long-term preservation, storing them in remote locations, and duplicating them are all practices observed in the United States at the government level since 1958 (Curry, 2022, p. 667). In those early days, with no feasible means of long-term storage, the first seed bank facility, the National Seed Storage Laboratory (NSSL), had to perform acts akin to archival retention schedule making, prioritizing keeping lesser-known and lesser available seed and plant germ refrigerated (Curry, 2022, p. 669). Scientists at the NSSL would occasionally test samples they had in abundance to determine their germination chances after being kept in a fridge for months (Curry, 2022, p. 671). The use of refrigeration and in-lab germination were techniques that were championed a decade earlier. Still, their replenishment methods were traditional—the NSSL scientists would ask for replacements from farmers and original donors of seeds if germination was unsuccessful, and they sought only seeds that were of then-current research interest "and typically did so with only short-term interests in mind" (Curry, 2022, p. 668). During the 1960s and 70s, as the research field grew, so did the number of seed and gene banks across the world, and new standards were developed through international treaties to ensure:

> [a]ny research institution with a significant seed collection would be expected to have two copies of that collection, one of which served as the source of seeds used and circulated (the active collection) and a second, kept under best-possible storage conditions and accessed only rarely. (Curry, 2022, p. 674)

Discussions around a globally focused, highly secure facility in Svalbard began in the 1980s when NordGen (formerly Nordic Gene Bank) established a backup seed storage facility in an abandoned coal mine outside Longyearbyen (SGSV, n.d.-b). The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), signed in 2001, called for a "multilateral system for plant genetic resources that includes global rules for access to and benefit sharing of those resources" (SGSV, n.d.-b). The Treaty outlined the parameters for the vault: any country that shipped seed samples to a seed vault in Svalbard would maintain ownership over the seeds, a legal responsibility on the part of the facility. Additionally, the shipping and handling of all willing contributions would be paid for by the Norwegian Government, as its standards for airmailing seeds in their desired and precise packaging could be considered a barrier for nation-run gene banks shipping to a seed bank thousands of kilometres away (SGSV, n.d.-b). The Treaty also indicated that depositors would agree to make their seeds available for research, plant breeding, and educational purposes (SGSV, n.d.-b).

Further, the Treaty sought to maintain "the conservation and sustainable use of all plant genetics resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use" (Food and Agriculture Organization of the United Nations [FAO], n.d.-a, para. 1). The SGSV aims to:

> [recognize] the enormous contribution of farmers to the diversity of crops that feed the world; [establish] a global system to provide farmers, plant breeders and scientists with access to plant genetic materials; [and ensure] that recipients share benefits they derive from the use of these genetic materials. (FAO, n.d.-b, para. 2)

The main provisions of the Treaty are formulated by an innovative multilateral system intended to provide access to the "global pool of genetic resources", which consists of 64 of the most important crops that provide 80% of the plants humans are dependent on for food (FAO, n.d.-b, para. 3).

To facilitate access to the genetic materials of the crops, countries must be a part of the Treaty's ratifying nations and must agree to use materials for "research, breeding and training for food and agriculture" (FAO, n.d.-b, para. 4). The Treaty does prevent those who are recipients of the genetic resources "from claiming international property rights" and it "ensures that access to genetic resources already protected by international property rights is consistent with international and national laws" (FAO, n.d.-b, para. 4). It also recognizes the rights of farmers who have significantly contributed to developing plant genetic resources globally. In addition to this recognition, the Treaty also protects farmers' traditional knowledge, increases their participation in decision-making processes, and ensures that they benefit from the use of resources that the Treaty provides (FAO, n.d.-b). The Treaty seeks to help "maximize the use and breeding of all crops and promotes development and maintenance of diverse farming systems" that not only wish to protect the four globally supporting crops – such as "rice, wheat, maize, and potatoes" – but also local crops that still highly contribute as major food sources communities internationally (FAO, n.d.-b).

Breaking Ground: The Svalbard Global Seed Vault

In 2004, a study revealed that the coal mine (the NordGen seed bank's original place of operation) would be insufficient to store and maintain the seeds for a long-term, globe-supporting, innovative, and climate-proof seed bank (SGSV, n.d.-b). The feasibility study outlined that the permafrost was not an optimal environment as the temperature keeps itself around minus 3.5 degrees Celsius, and the coal mine itself was not considered safe as it would leave the seeds exposed to high levels of hydrocarbon gases (SGSV, n.d.-b). The Norwegian government committed to funding a new seed vault in 2004, and four years later, the SGSV, overseen by NordGen, was opened on February 26, 2008, in Svalbard (SGSV, n.d.-b). Svalbard was specifically selected due to its location and environment. Its consistently low temperatures, among other characteristics, make it a suitable environment to store and preserve seeds. According to archival theorist Adrian Cunningham (2017), "The choice of a physical location of an archive says much about society's perceptions about its role and function culturally" (p. 54). Having a physical place to house archival materials ensures the integrity of those records, enables their future use, and marks the materials as significant enough to need a structure that protects them from corruption (Cunningham, 2017, p. 54). Svalbard's remote location, multiple security elements, and other physical and political factors make it an appropriate choice because the permafrost on Svalbard creates "natural freezing and provides unparalleled insulation properties for the seeds, even in the unlikely breakdown in the cooling equipment" (Westengen et al., 2013, p. 2) By being so remote, "human-related dangers" such as military activity (which is prohibited under the International Treaty of Svalbard, 1920) and infrastructure are said to have less of an effect on a vital-for-all-humanity collection of plant materials (Westengen et al., 2013, p. 2). Located within a mountain, its setting provides unparalleled security, being geographically stable with "low radiation levels" (Westengen et al., 2013, p. 3).

The SGSV is made up of seed deposits from international gene banks that hold long-term and sustainable seed collections from the areas, regions, or nations they represent. To deposit duplicates of their seed samples, the gene banks sign a depositor agreement where they are expected to comply with various outlined provisions (SGSV, n.d.-a). There are three main conditions indicated in the agreement that are essential to institutions who wish to make a deposit to the SGSV: 1) because the deposit will be part of a long-term and sustainable collection, the depositing gene bank or institution is expected to have the capacity to multiply new seeds when needed; 2) the depositor is required to state that deposited samples have been safely duplicated and that the SGSV is acting as a second security back-up; and 3) the depositor agrees to make their seed samples available for breeding, research, and education purposes based on the terms that are similar to the ITPGRFA (SGSV, n.d.-a). Once the depositor agreement has been signed, the depositing institution is expected to prepare an accession list based on the template and guidelines outlined, which should be submitted to NordGen six weeks before shipment (SGSV, n.d.-a). When shipping materials to the SGSV, the institution, and, by extension, the Norwegian government, is responsible for covering the costs associated with freight charges to the Oslo Airport and "Jetpak" transfer to Svalbard (SGSV, n.d.-a).

The SGSV was built as a means to protect essential scientific and cultural histories, as well as natural biodiversity for future use. The locked vault door, opened thrice annually, sits in front of a 300-foot tunnel or unloading area for materials. There is then an antechamber before one enters "the Cathedral," a large, cavern-like room where those about to enter the frozen chambers can add additional clothing layers. Once in the Cathedral, one can see three doors, each leading to rooms that exist as middle sections before being able to access the storage sub-vaults themselves, which together make up the capacity of the SGSV. The seeds are stored within the sub-vaults on shelves elevated off the ground, with the oldest donated seeds being kept in the first sub-vault until that sub-vault is full. After that point, newer seeds move to the second sub-vault for storage (SGSV, 2023).

The SGSV preserves nature and brings a different perspective to archival practices that could help kickstart life in case catastrophe strikes. In his book on the SGSV, Vincent Bruyère (2018) states:

> The seed bank ensures continuity by summoning a future against which it has been built. It marks and signifies the passage from a past to a future, from a time of climate felicity correlated with the birth of agriculture . . . to a time of climate disruption, mass extinction, and biodiversity loss. (p. 5)

What these prospective challenges mean to global agriculture cannot be overstated.

Seeds in this "perfect location" are kept with additional cooling mechanisms within the vault at minus 18 degrees Celsius. Should those additional cooling mechanisms fail, "[t]he permafrost in the mountains surrounding the

Seed Vault is certain to keep the seeds cold, for a long time, even in the event of no artificial cooling" (SGSV, n.d.-a). A humanitarian outlook helps guide the SGSV toward proper care and conservation methods to sustain global crop diversity against catastrophe. As a "'safety-net' in case something happens to the gene banks where plant genetic resources are currently stored," the SGSV contains copies of "many of the world's most important gene banks [including those that] are situated in politically unstable countries" (Qvenild, 2008, pp. 110-111). Seed banks around the world can be and are met with disaster—though not often of the scale of "doomsday," famine, or war. Sometimes, the loss of seeds could be associated with catastrophes that are simply mundane accidents, such as a poorly functioning freezer or power outages (Crop Trust, n.d.). As such, leaving the seeds in a highly vulnerable environment could lead to irreversible loss, putting them into the same extinction categories as dinosaurs, some animals, or other forms of life (Crop Trust, n.d.).

The SGSV is the largest seed bank in the world, with the capacity to store 4.5 million varieties of crops. Crops are most often stored in plastic boxes with origin and species identification labels and barcodes, with each country or organization's deposit kept together. Within each box lies any number of specially designed packets, containing an average of 500 seeds, totalling a storage capacity of 2.5 billion seeds (Crop Trust, n.d.). Currently, the vault houses 1.2 million seed samples from almost every corner of the planet, filling one and a half of their sub-vaults, making it the most diverse international seed vault currently active (Crop Trust, n.d; Greenfield, 2023). It not only acts as an insurance policy against catastrophe but also as "a monument to 12,000 years of human agriculture" (Greenfield, 2023).

The SWSV is still a work in progress. Despite precautions such as storing the seeds 500 feet away from the vault's entrance behind multiple doors and in boxes on shelves that do not touch the floor, in 2016, melting permafrost made its way into the first chamber of the seed vault. This was a wake-up call to many in the world of agriculture that some protective plans may still not be able to withstand the immense challenges that are presented by the climate crisis (Carrington, 2017). In the years since, doors and entryways have been further sealed (NordGen, 2020) and scheduled openings of the vault are limited to three times per year (Angel, 2023).

Expanding and Actionable Collections Mandates

The SGSV is keen to expand its outreach to new and existing partners to create a genuinely global seed vault. Ensuring outreach with non-governmental organizations, as well as Indigenous governments and communities, is essential to this process. In 2015, members of the Quechua people of Peru contributed the seeds of 410 potato varieties to the SGSV (International Institute for Environment and Development, 2017). It was an initiative important to the Quechua, not just the SGSV, as the deposited seeds are part of Quechua culture. For example, the potato variety particular to the Quechua (quachun waqachi) is part of a wedding ritual that "articulates the Andean belief that love and respect between humans depends on and is nurtured by the land and epitomizes the commitment of couples to protect their seeds and food systems" (Argumendo, as cited in Mortillaro, 2020, para. 10). Additionally, in 2020, members of the Cherokee Nation went to the vault to deposit nine types of seeds to the project (Lakhani, 2020), of which Cherokee Nation Principal Chief Chuck Hoskin Jr. stated:

> It is such an honor to have a piece of our culture preserved forever. Generations from now, these seeds will still hold our history and there will always be a part of the Cherokee Nation in the world." (Anadisgoi, 2020, para. 4)

Exactly as its mandate suggests, the SGSV has also been called upon when disaster strikes. In 2008, The International Centre for Agricultural Research in Dry Areas (ICARDA) was one of the first groups to deposit duplicates of their agricultural materials into the SGSV. Now decentralized but then based in Lebanon, their contributions to SGSV included "the largest collection of crop diversity from the Fertile Crescent, including barley, durum wheat, faba bean, chickpea and lentil" (Crop Trust, 2020, para. 3). Worries about large-scale agricultural destruction in Syria due to war spurred ICARDA into action, and by 2014, 83% of Syrian-based collections were shipped to Svalbard for protection, "with an additional 13,939 accessions sent to the national genebank in Turkey" (Crop Trust, 2020, para. 6), in hopes that by saving seeds the crops could be regenerated and made available for future use. In 2015, ICARDA made its first withdrawal from the vault to begin re-establishing its collections. Due to the hard work put in by ICARDA to save their collections, only 1,657 accessions were lost during this part of the (ongoing) war, and they successfully backed up almost 99% of their collections (Crop Trust, 2020). These examples demonstrate the importance of the emerging doomsday archives to protect culturally significant items and regenerate biodiversity vital for human survival.

Deviation from Traditional Archival Practice

If the SGSV is recognized as an archive, there are requirements to maintain its collection that force certain elements of "traditional" archival practice out the frozen door. The primary and perhaps most obvious difference is that the seed vault does not have a retention schedule. Traditional appraisal practices would see the record's "lifecycle", in other words, a record within the archive as having a re-appraisal or destruction date. Mazurczyk et al. (2018) argue:

> Archives preserve historical records in multiple formats that are critical for legal matters, administrative accountability, and documentary cultural heritage. When these records and documents are lost following extreme weather events . . . their absence severely handicaps socio-cultural and economic reconstruction efforts." (p. 112)

As such, it is essential for archives to meet the challenges of climate change and other catastrophes by implementing protection plans intended for present and long-term protection (Tansey, 2015, pp. 1–2), something that is integral to the makeup of the doomsday archive.

Despite the SGSV not being an archive in the traditional sense, it demonstrates characteristics of an emerging archive that, according to Mark Campbell (2020), enhances access to information while simultaneously challenging issues associated with traditional archives. The SGSV increases awareness for new generations of individuals to understand the importance of preserving the world's seeds against global catastrophes, resisting the erasure of agricultural histories, and increasing the recognition, value, and appreciation of individuals' thinking-ahead mentality (Campbell, 2020, p. 19). In this case, it is the intention that the SGSV will continue to play to these same sensibilities decades, if not centuries, from now.

Emerging archives, like the SGSV, test the boundaries of the archival field by incorporating new and innovative perspectives to reimagine and address societal changes: "peace and security, human rights, climate change, health and well-being, and adaptation to technological change in the information society" (Gracy, 2018, pp. ix–x). The SGSV challenges the way we think about and interact with records encapsulated within a doomsday archive that intends to safeguard essential elements of human life in case of the collapse of civilizations (Braidwood, 2023), but also in the event of catastrophic—but not always civilization-collapsing—events. According to Ella Braidwood (2023), these "doomsday" vaults do not just centre around preserving seeds. Researchers and scientists seek to preserve everything that could play a role in the blueprint of our recovery: DNA, data, and even feces (Braidwood, 2023).

The SGSV was created to protect and preserve historically, culturally, and naturally relevant records for future generations. Returning to the concept of retention periods, in the case of doomsday archives, should they apply? Gone are the days when seed banks did not have the capacity to regerminate seeds after freezing, and for the SGSV, space is of lesser concern compared to most other archives. As Barbara Craig (1992) outlines, "appraisal is a social action with broad consequences" (p. 176). Archivists shape societal memory, and the decisions they make regarding the appraisal of archival records are a defining role of the profession (Garaba, 2007, p. 59). If archivists within doomsday archives determined retention periods, inevitably destroying valuable information and life sources once the retention period ended, it would harm the societies that trusted these institutions. They would be destroying relevant information that could potentially be of value a hundred years from now. For an archivist to "control the documentation of the past" via retention schedules (Craig, 1992, p. 177) does not make sense in the context of a doomsday archive, as all records are essential and will continue to hold value for the generations that surpass archival practices of the present.

Another deviation from traditional archives is the fact that the SGSV has no permanent staff (NordGen, 2020). To ensure maximum security and environmental stability for the seeds, the vault is only opened three times a year by authorized personnel (NordGen, 2020). Staffing is heavily emphasized within archival literature, as is the prevalence of human involvement in providing access to records, but when access to records is intentionally limited and they are being stored for regenerative or rare research purposes, the access-related reasons for human staffing are of less importance. Additionally, with a publicly available record of what was stored in the vault when its storage cycle began, with its documented country of origin (Svalbard Global Seed Vault, n.d.), public collections knowledge and accessibility are higher for the SGSV than for many traditional archives, whose equivalent finding aids are not always publicly online or accessible at all.

Conclusion

Archives emerge to tell stories. Those stories are critical to how individuals and societies develop their identities and understandings of the past. The SGSV emerged to tell a different story, one that is focused on the long-term preservation of the world's future food supply. Though an untraditional archive, the SGSV's practices match some of the core functions of traditional archival practice, but what makes it unique is its purpose-built facilities and the intention behind its creation: being ready for doomsday scenarios. Many aspects of the world's biodiversity are essential to daily human life, and ensuring they remain protected from natural and human-caused catastrophes is crucial. It is unclear whether the worst will happen, and what exactly such an event would look like, but it is reassuring that life can be regenerated to a certain capacity through the collections at SGSV.

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